REMARKS

This paper is submitted in reply to the Office Action dated May 8, 2003, within the three-month period for response. Reconsideration and allowance of all pending claims are respectfully requested.

In the subject Office Action, claims 28-29 were rejected under 35 U.S.C. § 112 second paragraph. Moreover, claims 20-27, and 47-50 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,895,239 to Jeng et al.

Applicants respectfully traverse the Examiner's rejections to the extent that they are maintained. Moreover, Applicants have amended claims 20 and 24-25 and added new claims 63-72. Applicants respectfully submit that no new matter is being added by the above amendments, as the amendments are fully supported in the specification, drawings and claims as originally filed.

Now turning to the subject Office Action, and in particular to the §112 rejections, claims 28 and 29 were rejected by the Examiner as being indefinite, as the Examiner was of the belief that the terms "positive serpentine pattern" and "negative serpentine pattern" were not clearly defined. However, the Examiner will note that these terms are specifically discussed at page 14 of the Application, and clearly illustrated in Figs. 1, 4 and 10. Specifically, a "positive serpentine pattern" (which is shown in Fig. 1, and also shown as element 13A in Fig. 10) includes a series of parallel-extending legs that are joined to one another at alternating ends. In a "negative serpentine pattern" (which is shown in Fig. 4, and also shown as element 13B in Fig. 10), the structure of the capacitor (e.g., the bottom and top layers and the insulator layer) is segmented by parallel-extending voids joined to one another at alternating ends – i.e., the negative serpentine pattern is predominantly a negative image of the positive serpentine pattern.

Given that both terms are described in the Application, and that specific examples are illustrated in the Figures, Applicants respectfully submit that these terms would be

well understood by one of ordinary skill in the art reading the Application. Withdrawal of the §112 rejections of claims 28 and 29 are therefore respectfully requested.

Next, turning to the art-based rejections, and specifically to the rejection of independent claim 20, this claim generally recites a metal-insulator-metal (MIM) capacitor structure for use in an integrated circuit. The MIM capacitor structure includes first and second legs extending generally parallel to one another and defining a channel therebetween, with each leg including top and bottom electrodes, an insulator layer interposed between the top and bottom electrodes, and a sidewall that faces the channel. The structure also includes a first sidewall spacer extending along the channel, where the first sidewall spacer includes a conductive layer and a dielectric insulator layer interposed between the conductive layer and the sidewall of the first leg, and where the conductive layer of the first sidewall spacer is physically separated from the top electrode of the first leg.

Claim 20 has also been amended herein to further recite a second sidewall spacer extending along the channel, where the second sidewall spacer includes a conductive layer and a dielectric insulator layer interposed between the conductive layer and the sidewall of the second leg, and where the conductive layer of the second sidewall spacer is physically separated from the top electrode of the second leg. Furthermore, the claim as amended now recites a dielectric material disposed in the channel and interposed between the conductive layers of the first and second sidewall spacers. In concert with the amendments to claim 20, claims 24 and 25 have also been amended to clarify that the recited sidewall spacer is the "first" sidewall spacer. Support for these amendments may be found, for example, in Figs. 2, 3 and 6F, as well as at pages 10 and 21-22, of the Application as filed.

Applicants respectfully submit that the prior art cited by the Examiner fails to disclose or suggest each and every feature recited in claim 20, most notably the provision of a pair of sidewall spacers in a channel between first and second legs of a MIM

capacitor structure, with a dielectric material disposed in the channel and interposed between the respective conductive layers of the sidewall spacers.

Indeed, the Examiner appears to acknowledge that Jeng et al. does not explicitly disclose a sidewall spacer including a conductive layer. Instead, the Examiner considers element 32A (disclosed at column 7, lines 1-2 to be a "tungsten bit line") to be capable of functioning as a component of a sidewall spacer. Applicants respectfully disagree with the Examiner's characterization of the tungsten bit lines 32A as being analogous to conductive layers in a sidewall spacer, as there is no support in the reference relating to the desirability of this characteristic.

Nonetheless, it is important to note that element 32A, which the Examiner analogizes to a conductive layer in a sidewall spacer, extends completely across the width of the channel (defined by the Examiner as the region between two electrodes 44'), and abuts insulative sidewall spacers 38 on each side of the channel.

Claim 20, on the other hand, now recites first and second sidewall spacers, where each sidewall spacer includes a conductive layer and a dielectric insulator layer. Furthermore, the claim now recites that a dielectric material is disposed in the channel and interposed between the conductive layers of the first and second sidewall spacers. No such equivalent structure is disclosed or suggested by Jeng et al., as the tungsten bit lines 32A extend completely between the insulating sidewall spacers 38 of Jeng et al. Moreover, Applicants respectfully submit that one of ordinary skill in the art would not be motivated to provide any such insulating material within the bit lines of Jeng et al., given the principal use of the conductive material in each region 32A as a bit line.

As such, Applicants respectfully submit that there is no suggestion in the reference, or otherwise in the prior art, to provide a pair of sidewall spacers having respective conductive layers that are separated by an intervening dielectric material. Claim 20 is therefore non-obvious over Jeng et al. Reconsideration and allowance of

claim 20, as well as of claims 21-29 which depend therefrom, are therefore respectfully requested.

Next, with respect to independent claim 47, this claim recites a MIM capacitor structure that includes top and bottom electrodes and an insulator layer interposed between such electrodes, and where the bottom electrode includes an ammonia plasma treated surface.

Applicants respectfully submit that the Examiner has failed to cite any disclosure in Jeng et al. that suggests the use of an ammonia plasma treated surface for a bottom electrode of a MIM capacitor structure.

In rejecting claim 47, the Examiner relies on column 7, lines 38-52 of Jeng et al. In addition, in rejecting claim 23,which likewise recites an ammonia plasma treated surface, the Examiner cites column 6, lines 35-65, and column 7, lines 25-58.

However, in none of these passages, or anywhere else in Jeng et al., is there any disclosure of the treatment of an electrode material via ammonia plasma treatment.

Instead, the cited passages all deal to varying extents on the use of ammonia (NH_3) in a chemical vapor deposition (CVD) process for depositing TiN. Specifically, at column 7, lines 50-52, Jeng et al. discloses that a bottom electrode "can also be other electrically conducting materials such as TiN, which can be deposited by CVD using $TiCl_4$ and NH_3 as the reactant gases. "

(47) ⇒ The use of ammonia as a reactant gas during the deposition of a conducting material using CVD, however, is not analogous to ammonia plasma treatment. Jeng et al. uses ammonia only to provide a source of nitrogen during CVD deposition of TiN. Moreover, there is no disclosure or suggestion that a plasma is formed during this CVD deposition process. Furthermore, it is well known in the art that ammonia plasma treatment is a post-deposition process, and the only disclosure in Jeng et al. related to ammonia is in connection with a deposition process itself, where the ammonia is a reactant gas, and not to any type of post-deposition treatment.

Accordingly, Applicants respectfully submit that Jeng et al. fails to disclose or suggest the claimed capacitive structure comprising a bottom electrode with an ammonia plasma treated surface. Claim 47 is therefore non-obvious over Jeng et al. and the other prior art of record. Reconsideration and allowance of claim 47, as well as of claims 48-52 which depend therefrom, are therefore respectfully requested.

As a final matter, Applicants have added new claims 63-72, with claim 63 being independent. Claim 63 recites a MIM capacitor structure comprising a serpentine pattern including first and second legs extending generally parallel to one another, with the serpentine pattern further including a substantially co-planar top electrode, a substantially co-planar bottom electrode, and a substantially co-planar insulator layer interposed between the top and bottom electrodes.

As illustrated, for example, in Fig. 3 of the Application as filed, each of the bottom and top electrodes and insulator layers is deposited in a horizontal plane relative to the substrate. Furthermore, the legs of the capacitive structure are arranged in a serpentine pattern taken from the perspective of a plan or overhead view of the substrate (see, e.g., Fig. 1). In contrast, Jeng et al. discloses a capacitive structure in which the serpentine pattern is defined in cross-section, with portions of each of the top and bottom electrodes and insulator layers extending in a non-co-planar fashion (note that each such component transitions from horizontal and vertical orientations). In an overhead view, e.g., as shown in Fig. 15, no pattern even arguably analogous to a serpentine pattern is presented in Jeng et al.

Applicants therefore respectfully submit that Jeng et al. does not disclose or suggest a capacitive structure which, in connection with the other features recited in claim 63, incorporates co-planar top and bottom electrodes and insulator layers. Consideration and allowance of claim 63, as well as of claims 64-72 which depend therefrom, are therefore respectfully requested.

In summary, Applicants respectfully submit that all pending claims are novel and non-obvious over the prior art of record. Reconsideration and allowance of all pending claims are therefore respectfully requested. If the Examiner has any questions regarding the foregoing, or which might otherwise further this case onto allowance, the Examiner may contact the undersigned at (513) 241-2324. Moreover, if any other charges or credits are necessary to complete this communication, please apply them to Deposit Account 23-3000.

Respectfully submitted,

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Date

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